International Journal of Innovation, Creativity and Change. www.ijicc.net
Volume 9, Issue 9, 2019

Analysing the Use of Business Simulation to Build Entrepreneurial Leaders: The Case of UAE Learners

Alfred Howard Miller[a], Shiladitya Verma[b], Fatima Alloghani[c], Suhair Alwahabi[d], [a,b,c,d]Higher Colleges of Technology, Fujairah, UAE, Email: [a]amiller@hct.ac.ae, [b]sverma@hct.ac.ae, [c]falloghani@hct.ac.ae, [d]salwahabi@hct.ac.ae

The purpose of this study is to measure the relationship between developing entrepreneurial leaders and their successful performance in business simulation. At Higher Colleges of Technology (HCT) in the United Arab Emirates (UAE), learners do Strategic Management and business simulation courses during the third year of their Bachelor's degree. By the time they do the business simulation course, they will already have taken at least one or two courses in each of marketing, management, accounting, business statistics, international business, finance and innovation and entrepreneurship. These students already have an introductory exposure to the main concepts that comprise the business core. Theoretically, they are ready to test their knowledge, understanding and skills at the applied learning level. Thus business simulation is seen as a capstone course for the business-core courses. For this study, comparative performance metrics in the student group project, student self-reflective statements, overall placement in the simulation game and total shareholder return of a simulated mobile phone company are matched to the data visualisation graphics. Data visualisation is enabled by KH Coder, an unsupervised machine learning, quantitative text-analysis process. Technologies used in the analysis include correlation co-occurrence networks, centrality co-occurrence networks and multidimensional scaling. A linkage is struck between high performance in the business simulation course via a set of metrics and the visual content of the graphics, representing students' understanding of the simulation. The high performing teams in the simulation – those who best modelled overall competitive and financial success in the game – exhibited a unique pattern of understanding. Using a pattern-matching approach, a clear data structure emerges that separates high-performing teams from their competitors. This study documents success via modelling innovation and entrepreneurship through participation in strategic management and business simulation courses. The results highlight the importance of learner participation in overall innovation and entrepreneurship education, and the financial literacy gained from participating in business simulation. While business simulation is currently a hot topic, limited research is available from the Middle East connecting entrepreneurship and innovation to success in business simulation. This study takes a data analytics approach to demonstrate the value of participating in business simulation. There is a strong connection between performing well in business simulation and the unique pattern that emerges from the data analytics of the text of what students feel they have learned.

Key words: *Entrepreneurial finance, innovation, business simulation, machine learning, content analysis, natural language processing, total shareholder return, modelling.*

Introduction

A practical course in business simulation is a common attribute of a wide range of business programs, at both the undergraduate and graduate levels. Such a course is often taken as capstone or summative measure of students' learning across the range of core business courses. Several authors contributing to the World Economic Forum's *Report on Entrepreneurship* (2009) suggest by using business simulation, education can contribute to the development of entrepreneurial talent. This is important because university business programs face a salient challenge in demonstrating to key stakeholders, such as accreditors, employers, graduates and government, that upon graduation learners are leaving the program with the required level of financial skills, entrepreneurial knowledge, tools and understanding to contribute successfully to the workplace and society.

Business programs face a dilemma regarding how to provide learners with the skills that will enable them to successfully launch and operate an entrepreneurial venture. Business simulations can be fun and highly competitive (Vyakarnam, 2009), and they give students a way to test their business management skills in a simulated environment on a trial basis without risking actual capital (Neely & Tucker, 2012). A key challenge is to make the simulation relevant and align the assessment of the simulation with course and program learning outcomes (Markulus, Nugent & Strang, 2015; Rogmans, 2016).

A total of 186 students participated in the simulation in this study over seven semesters, distributed across 56 teams. The performance of 125 students across the 44 teams mentored and assessed by the principal investigator for their group project was analysed for this study. Learners usually played three practice rounds followed by an eight-turn simulation competition, the Cesim Global Challenge.

Learners were assessed via individual case-oriented written tests over strategic management and business simulation basics, followed by a mid-term test, which was based more on learners' understanding of the ongoing simulation. Students completed a group project at the end of the semester based on their team's performance in the competition, which was a written report analysing their simulation performance. The project rubric measured reporting of their strategy, which includes short- and long-term strategy and financial objectives, and soft-skill factors related to the workings of the team and a SWOT (strengths, weaknesses, opportunities and threats) analysis. Teams also focused on performance metrics such as earnings before interest and taxes, return on equity, equity ratio, earnings per share, market share and total shareholder return. Finally, students were required to briefly reflect on what they had learned. Each student sat for a final exam, a centralised system-wide assessment delivered across as many as 16 campuses.

This study focuses on (1) the teams' success in achieving the winning criteria of total shareholder return (TSR); (2) their overall placement in the simulation, with first place being the best; (3) the teams' grade on the group project; and (4) a natural language processing of their reflective statements, using KH Coder to deliver a visual content analysis. The content analysis explores whether winning teams viewed and understood the simulation differently.

This study sought to answer the following questions: Does success or even failure in a business simulation provide evidence that some amount of entrepreneurial learning has occurred? Is there sufficient evidence for modelling that the students have acquired the necessary entrepreneurial skills and financial thinking required to actually operate a competitive business; and, hence, do simulations contribute to the art of developing entrepreneurial leaders?

Research Aims and Objectives

The aim of this study was to use content analysis and descriptive statistical analysis to evaluate characterisation of students' business simulation performance. The performance evaluation should include elements of performance on the group project and actual placement in the game. Furthermore, this study sought to obtain a viable, yet simple metric to quantify student performance in a more holistic way than using total shareholder return alone.

Using KH Coder (2018), a quantitative means of natural language processing, for content analysis, the researcher was informed visually, and was able to make a qualitative assessment of computer-generated graphic visualisations of the data. The aim was to discover whether high-performing learners in the Global Challenge differed significantly from those who did not perform well in the simulation. It was postulated that with a high metric performance in the simulation, strategic approaches and other thought processes that lead to success could be embedded in the students' attitudes and perspectives about the simulation, and that these notions would be shared in their reflective statements from the project. By seeking to uncover the post-simulation mindset of participating learners, the researcher sought to model simulation performance and make a connection to the art of developing financially adept entrepreneurial leaders.

Research Questions

Q1 How does a team's performance in a business simulation impact students' development as entrepreneurial leaders?

Q2 Is it possible to develop a business simulation algorithm that signals the extent to which acquisition of entrepreneurial skills leadership has been demonstrated?

Background to the Research

The scholarly literature reviewed for this study aimed to identify any connection between business simulation games and success in entrepreneurship, with the purpose of providing background to help answer the question of whether participating in such simulations had any impact on the art of developing entrepreneurial leaders. The articles selected describe learning interactions using business simulation in the United States, the Middle East, Europe and Asia.

Vnoučková (2018), based in the Czech Republic, found that an age of 25–40 and tenure at the firm of between one and five years led to the highest levels of creativity. This result was an outcome of a 134-respondent survey. Supporting the quantitative interpretation of that data was a qualitative interpretation of content analysis, of the answers to 18 open-ended questions. These questions were asked of five out 17 projects identified that met the criterion of being in the acceleration phase of entrepreneurial progression. The quantitative content analysis yielded 39 criteria, of which 10 were qualitatively identified as crucial for the successful development of the project. These 10 crucial factors were: use of education/training, development, partner, theoretical mapping, use of technical assistance, use of technologies, conception of project management, solution functionality, interest in a solution and solution efficiency.

A factor analysis study reported on innovativeness, proactiveness, risk-taking, globalization and performance for 70 SMEs in Malaysia. The findings suggested that the more global a firm was, the more innovative, proactive and prone to take risks it would be, compared with a firm with a more local focus. The key recommendation was to achieve competitiveness under globalisation, using an SME focus on promotion program, trade fare exhibition and participation in export market conferences to encourage growth of export market opportunities (Amin, Baroto, Rasid, & Ahmad, 2012).

A qualitative study that was reviewed utilised the same CESIM simulation as that used in the current study in the global telecommunication market. The first part of the study saw 116 vocational learners from the third year of high school take a 14-question pre-test, with seven questions on digital competency and seven questions on entrepreneurial competency. Then 63 of these learners participated in the business simulation activity. The participants were weak in digital competency, scoring 25–50 per cent, and weak in entrepreneurial competency, scoring between 7.14 and 61 per cent. Ninety-seven learners participated in the post-test and a 10 per cent improvement was noted in both areas post-simulation, with a 20 per cent improvement when tested with a new set of questions.

The second part of the study uncovered a wide range of positive factors, and influences that supported the development of participants' entrepreneurial skills. The scope of this second part had a major limitation in that only nine participants, limited to three teams, took part. These constructs included stimulation and enjoyment as a prerequisite of learning, teamwork, a risk-free environment at both the individual and organisational levels. They also included a learning method that contrasted and complemented case studies and lectures, was experiential and hands-on by nature, and allowed experimentation with new strategies, without the inherent risks of the real world of business.

These proponents of business simulation gaming also reported that rapid and clear feedback from the simulation, along with teams' realised consequences of their actions in the game, promoted the development of teamwork, interest in the simulation, motivation to win, problem-solving skills, creativity and critical thinking. Training for this part was delivered in a corporate setting, at the MBA level, in Croatia. Trainers directed winners and certain high-performing participants towards strategic managerial positions (Barišić & Prović, 2014).

Miller (2016) deployed a 60-sample pilot study at Higher Colleges of Technology in the United Arab Emirates (UAE). It involved cross-disciplinary learners participating in the Cesim simulation. The procedure used to model business simulation was, guided by Rommes' Dynamic Capabilities model, and used the structural equation modeling (SEM) techniques of both factor and path analysis to model the business simulation learning experience. In the Miller (2016) study, the strongest correlations were shown between the assessment items. The highest correlations between experiential factors was .538 between perceived realism (of the simulation) and preparation to run own business. Other correlations noted were .356 between perceived realism and coursework, and .338 between probability to run own business and team placement. The study was robust, having assessed normality, reliability and statistical power. Validity, however, was diminished by the pilot study-sized sample.

In another study from Higher Colleges of Technology (UAE) about business strategy simulation, a qualitative phenomenological approach was deployed via a focus group setting, by De Klerk (2015), who reported that student perceptions of the use of a business simulation and through students' lived experiences helped them to understand and apply learning of business concepts.

Game-based learning, via the Cesim Global Simulation, was also explored by Kikot, Fernandes, Magalhães and Costa (2013) in Portugal, using focus group interviews. The Cesim Global Challenge is deployed on the third year of the Bachelor's degree in their entrepreneur games course. A key finding was that the more collaborative groups used more time in the simulation, and achieved a higher position in the game. The researchers reported that embedding the simulation into a subject curriculum made a teacher-centric classroom much more learner-centric. Sample size was stated by authors of the study as a limitation; only 29 learners had participated in what was an optional class during the previous academic year (Kikot et al. 2013).

In a meta-analysis of 49 simulations and simulation websites, researchers commented favourably on the Cesim Global Challenge; however, their interpretation focused more on the competing in Capsim, XM Comp and Zoom simulations. The context of the study was to explore the AACSB's concept of assurance of learning. A key issue was the determination of whether the assessment strategy contained in the simulation matched the learning goals of the particular course or program. Faculty and assurance of learning committees must expend time and effort to assess a given simulation's value as a summative assessment (Markulus, Nugent & Strang, 2015). The authors concluded off-the-shelf business simulations fell short in the measurement of student learning at the summative assessment level.

Neely and Tucker (2012), of Ashford University, concurred. They reported using not only an extensive process, but also several committees' time and effort, to evaluate the assurance of learning of a range of simulations. After setting course and learning goals, they aimed to match these with the assessment modules of different simulations. Their exhaustive study reviewed many simulations, and included interviews with many of the simulation providers. Neely and Tucker (2012) concluded that simulations motivated students to interact with complex systems and concepts, but assessment of actual learning still presented a challenge and played a key role for faculty and assessment committees (Neely & Tucker, 2012).

Rogman, operating at Zayed University, a federal university in the UAE, highlighted advantages in teaching the following international business topics using simulations: cross-cultural management, international expansion strategies, tax optimization, the role of import duties and transport costs, offshoring, currency fluctuations, and adaptation of products and prices to local consumer preferences (Rogman, 2016). These features are all present in the Cesim simulation (Cesim, 2018). Rogman asserted that the winning criteria needed to be stated explicitly by the instructor. Regarding assessment, Rogman also stated that while directly linking simulation performance to a student's grade seemed rather obvious, the competitive nature of the simulation could inhibit collaboration, particularly in more collective cultures:

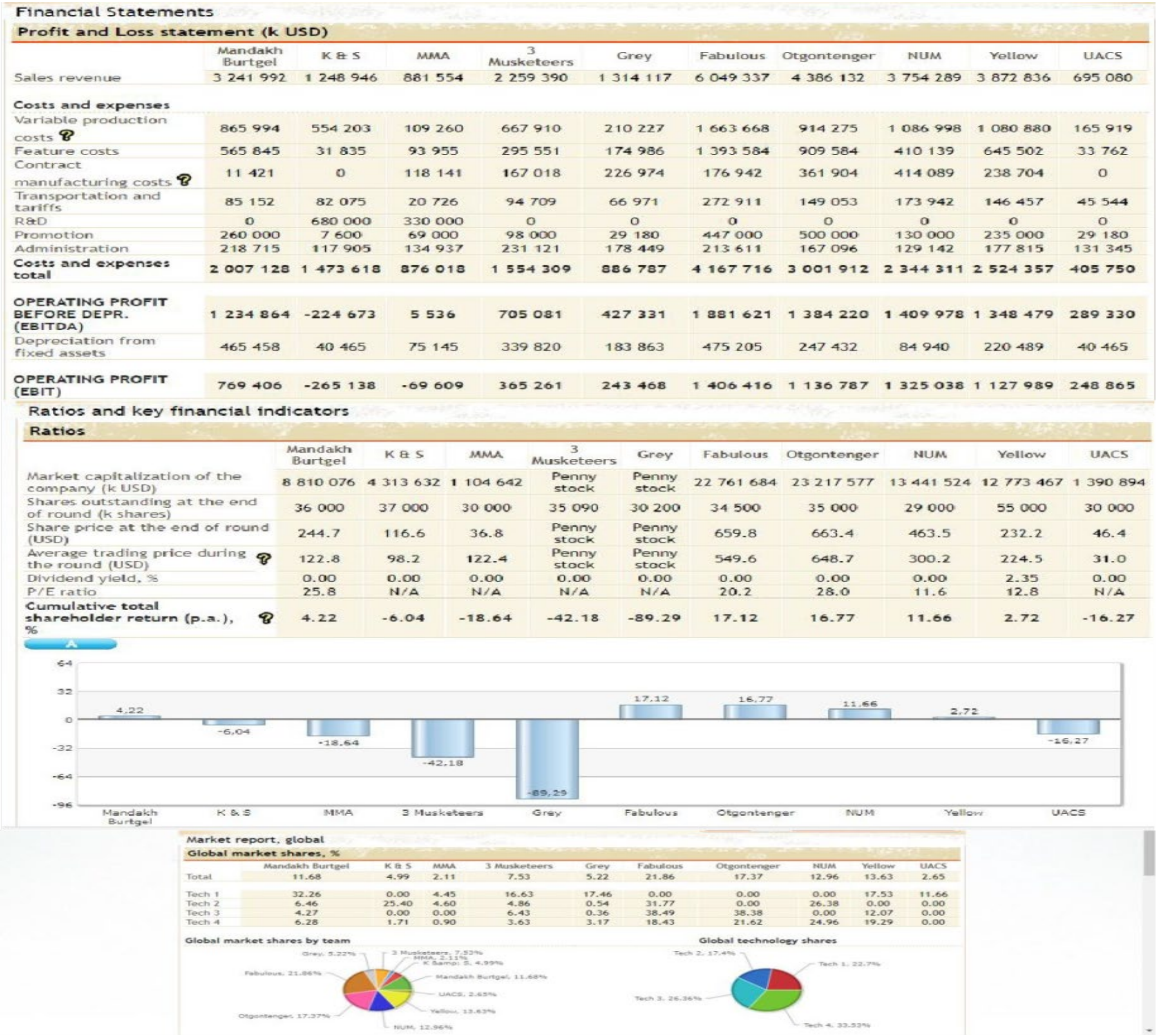
> Game performance may not always be a good reflection of learning and understanding. Sometimes the lower ranked teams have made far greater efforts, have learned more, and end up with superior understanding, as they have learned from mistakes made early in the game. (Rogman, 2016: 20)

Simulation is a key component of entrepreneurship education (Vyakarnam, 2009). Early growth and development of the enterprise provided both a good case and a subject for reflection, as well as a topic for business plans (Volkmann, 2009). Wilson made the overall recommendation that simulations and games were valuable as an interactive youth entrepreneurship pedagogy (2009). Researchers recommended that youth entrepreneurship education should continue to pioneer digital learning strategies, and the Cesim Global Challenge simulation game was specifically cited in the World Economic Report as an early adopter of these digital strategies (Mariotti & Rabuzzi, 2009).

ACBSP Region 8 included a Cesim Global Challenge simulation competition as part of its 2016 regional meeting in Dubai. Ten teams competed, including from Europe, the Middle East and Central Asia. A team from Sharjah, UAE, called Fabulous, was first overall with a total shareholder return (TSR) of 17.12. The simulation was closely contested and

Otgontenger University from Mongolia came in second place, with a TSR score of 16.77. Another team from Mongolia, National University of Mongolia (NUM), had a TSR of 11.66. Not all teams performed well and two teams bankrupted themselves by the end of the eight-turn simulation, with TSR values of –42.18 and –89.29 respectively (see Figure 1).

Figure 1. Cesim Global Challenge results at ACBSP Region 8, Dubai, November 2016



Financial Statements

Profit and Loss statement (k USD)

	Mandakh Burtgel	K & S	MMA	3 Musketeers	Grey	Fabulous	Otgontenger	NUM	Yellow	UACS
Sales revenue	3 241 992	1 248 946	881 554	2 259 390	1 314 117	6 049 337	4 386 132	3 754 289	3 872 836	695 080
Costs and expenses										
Variable production costs	865 994	554 203	109 260	667 910	210 227	1 663 668	914 275	1 086 998	1 080 880	165 919
Feature costs	565 845	31 835	93 955	295 551	174 986	1 393 584	909 584	410 139	645 502	33 762
Contract manufacturing costs	11 421	0	118 141	167 018	226 974	176 942	361 904	414 089	238 704	0
Transportation and tariffs	85 152	82 075	20 726	94 709	66 971	272 911	149 053	173 942	146 457	45 544
R&D	0	680 000	330 000	0	0	0	0	0	0	0
Promotion	260 000	7 600	69 000	98 000	29 180	447 000	500 000	130 000	235 000	29 180
Administration	218 715	117 905	134 937	231 121	178 449	213 611	167 096	129 142	177 815	131 345
Costs and expenses total	**2 007 128**	**1 473 618**	**876 018**	**1 554 309**	**886 787**	**4 167 716**	**3 001 912**	**2 344 311**	**2 524 357**	**405 750**
OPERATING PROFIT BEFORE DEPR. (EBITDA)	**1 234 864**	**-224 673**	**5 536**	**705 081**	**427 331**	**1 881 621**	**1 384 220**	**1 409 978**	**1 348 479**	**289 330**
Depreciation from fixed assets	465 458	40 465	75 145	339 820	183 863	475 205	247 432	84 940	220 489	40 465
OPERATING PROFIT (EBIT)	**769 406**	**-265 138**	**-69 609**	**365 261**	**243 468**	**1 406 416**	**1 136 787**	**1 325 038**	**1 127 989**	**248 865**

Ratios and key financial indicators

Ratios

	Mandakh Burtgel	K & S	MMA	3 Musketeers	Grey	Fabulous	Otgontenger	NUM	Yellow	UACS
Market capitalization of the company (k USD)	8 810 076	4 313 632	1 104 642	Penny stock	Penny stock	22 761 684	23 217 577	13 441 524	12 773 467	1 390 894
Shares outstanding at the end of round (k shares)	36 000	37 000	30 000	35 090	30 200	34 500	35 000	29 000	55 000	30 000
Share price at the end of round (USD)	244.7	116.6	36.8	Penny stock	Penny stock	659.8	663.4	463.5	232.2	46.4
Average trading price during the round (USD)	122.8	98.2	122.4	Penny stock	Penny stock	549.6	648.7	300.2	224.5	31.0
Dividend yield, %	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.35	0.00
P/E ratio	25.8	N/A	N/A	N/A	N/A	20.2	28.0	11.6	12.8	N/A
Cumulative total shareholder return (p.a.), %	**4.22**	**-6.04**	**-18.64**	**-42.18**	**-89.29**	**17.12**	**16.77**	**11.66**	**2.72**	**-16.27**

Market report, global

Global market shares, %

	Mandakh Burtgel	K & S	MMA	3 Musketeers	Grey	Fabulous	Otgontenger	NUM	Yellow	UACS
Total	11.68	4.99	2.11	7.53	5.22	21.86	17.37	12.96	13.63	2.65
Tech 1	32.26	0.00	4.45	16.63	17.46	0.00	0.00	0.00	17.53	11.66
Tech 2	6.46	25.40	4.60	4.86	0.54	31.77	0.00	26.38	0.00	0.00
Tech 3	4.27	0.00	0.00	6.43	0.36	38.49	38.38	0.00	12.07	0.00
Tech 4	6.28	1.71	0.90	3.63	3.17	18.43	21.62	24.96	19.29	0.00

Business simulation exposes learners to management decision-making. Accordingly, learners practise and implement their knowledge to proceed in the game and compete with other teams aiming to stay on top of the other companies. Learners come to recognise the tactics of the simulation, evaluate the process and the performance of their own and other teams, and then spot the opportunity to lead among competitors. This represents the cognitive level reached by learners during the simulation. It was noticed that entrepreneurial cognition skills created balanced and rapid development in the business simulation game (Heydari, Xiaohu & Wang, 2019).

From a more generic perspective of innovation management, Zhang et al. (2018) assessed how a massive open online course (MOOC) presented challenges to teachers and students, such as high drop-out rates – possibly due to there being no face-to-face interactions between the students and the teachers. From a positive perspective, their research pointed out that an online forum to solve students' issues might also motivate them to stay involved in a course and that physical presence might increase the level of enthusiasm and student engagement.

At different stages, learners built other skills – especially the top teams. These skills included entrepreneurial self-efficacy, which can be gained through experience and practice as described in the seminal study of Bandura (1977). It is postulated that the actions and emotions of team members during the simulation reflect critical thinking and risk-taking decisions, which are aspects of entrepreneurial thinking. Shaheen and Al-Haddad (2018) discussed the traits of self-efficacy and its impact on entrepreneurship, with the supporting positive effect of self-efficacy on financial controls and decision-making on building an entrepreneurial mindset.

Students learn to strategise in simulations, and Usoro (2001) emphasizes that information technology is assisting global managers in their planning. Usoro concludes that the internet provides the most popular platform for building global planning tools. The imperative factors for global managers were provision of timely information, reports and presentation facilities, support for group work, and alternative views of information. Alternatively, Lee, Hung and Chau (2011) postulate that knowledge management infrastructure provides a basis for management, and represents valuable information in organisations. Based on the resource-based view and process level analysis, they studied how knowledge management infrastructure impacted market interrelationship performance via advanced business processes, technology and cultural capability.

Similar to the mobile phone market explored in the Cesim simulation, Kumar and Ryoke (2013) propose a market research model to evaluate the effects of business strategy based on mobile phone usage. Their simulation assisted policy-makers in mobile telecommunication to understand current user sentiment and forecast the response of users before any new service was launched onto the market. They used the Agent-Based Simulation (ABS) method to simulate the product movement in the market. The results could be used to implement this same model with few adjustments, to predict product movement in any market condition. The researchers extensively used Conjoint Analysis to determine the user utility function, which is evidence of an advanced skill set that can potentially be deployed by students. Their research was carried out in three steps. First, a user survey was conducted to gather information on the users and their priorities. Then, using the raw data, conjoint analysis was used to identify the utility functions. Finally, the simulation and modelling of mobile phone usage was constructed according to the user mobility function and the influence of other agents.

Even more abstract was the research of Jinfu (2017), who proposed a novel textile production management system that strengthened the interactivity between the user and the system. It embodied intelligent decision-making and customised service. He extracted information from massive production processing data by analysing production processes and business work-flow in textile processing. Jinfu developed a production management structural relationship model that was superior to existing systems.

The Cesim simulation platform has been widely deployed, is well known in some of the literature and is a respected brand. A common theme was how to effectively incorporate business simulation into the assessment strategy. Factor analysis, content analysis, pre-test/post-test, both descriptive statistics and hypothesis testing were potential quantitative methods. Qualitative methods included questionnaires, open-ended questions, meta-analysis, and focus groups. A recurrent critique was the use of fairly small sample sizes and a lack of statistical power. Qualitatively, it is suspected that superior understanding by participating learners can be rooted in learning from mistakes made during the game, and learning by doing.

Business management simulation can play a vital role in enhancing and developing entrepreneurial skills among the team, through the instructor encouraging the learners and by awarding marks for innovative solutions. By rewarding innovative business strategies, teams were led to create new strategies and amend existing ones to earn marks in the course and successfully compete with other teams. In the implementation of business simulation in the Higher Colleges of Technology for business learners, the simulation seemed to encourage teams to innovate in business processes and strategies, based on their reflective statements. Thus simulations appeared to be helping to build an entrepreneur mindset for the future.

Castellano, Corsi, Bartolini, Bernini, Cardoni, Coller, Fasone and Fornaciari (2018) used text mining analysis as the primary quantitative approach in their performance management and measurement study. Closely aligned were firm performance, financial performance and strategic management, but not business models. They collected 220 publications from

38 highly ranked journals, matching strategy and performance keywords for the KH Coder analysis. The quantitative text analysis used co-occurrence network and centrality betweenness.

Descriptive Analysis of Simulation Metrics

The simulation metrics analysis uses a descriptive statistics approach. The frame is comprised of 186 students who participated on 56 Cesim (brand) Global Challenge simulation teams across seven semesters. Of those, 125 students, and 44 teams, were mentored by the principal investigator for their simulation competition. Thus students completed the group project as set out by the principal investigator (PI), and the PI uniformly assessed them using a rubric. Sixty-one additional students, on 12 teams, were mentored by two other instructors, over two semesters, Summer and Fall 2016. Other instructors' students participated in the simulation, and contributed to metrics regarding the overall placement of teams in the simulation, and their score for total shareholder return (TSR). Only the principal investigator's students were assessed on all four modes of success related to their performance, and on their outcomes from participating experientially in the business simulation. These four modes are:

1 assessed score on a written report about their team's simulation performance.
2 overall team placement in a competitive simulation universe.
3 overall annualised total shareholder return
4 content analysis of the student's self-assessment of their development of an entrepreneurial mindset.

The PI was the primary instructor for the strategic management and business simulation class. The class serves as an undergraduate capstone for the business core subjects, and it is taken in Year 3 of the Bachelor's degree. Students competing in the simulation had completed all the business common core subjects. Depending on the actual semester when the course was taken, they may perhaps have some limited coverage of their specialisation courses, beyond the common core. Students then went on to complete Year 4 and a second capstone class, an integrated project, to conclude their degree study.

Data taken from the seven business simulation semesters ranged from Spring term 2015 through Summer 2018. A total of 10 Cesim universes studied. Ten universes compared with seven semesters can be explained by three of the semesters having enough learners for two universes instead of one. The 56 teams in the simulation yielded an average of 5.6 teams per universe, although some universes had as many as nine teams, and others as few as three teams. See performance metrics data in Figure 2.

Figure 2. Cesim Global Challenge Performance Metrics 2015-2018. Algorithm for positive TSR scores = TSR x Project Grade x Placement; Algorithm for negative TSR scores = TSR / Project Grade x Placement

Spring 2015 Team Name	Project Grade	Placement	TSR	Performance Factor
CONECT	82.00%	1	23.84	19.55
VIP	82.50%	1	17.49	14.43
Red	83.60%	5/6	14.69	10.23
Blue	84.40%	4/5	9.35	6.31
Legend	82.50%	2/3	10.87	5.98
Divergent	83.50%	1/2	6.59	2.75
Pink	83.5%	3/5	5.36	2.69
White	83.00%	5/6	-7.3	-7.33
NAVY	83.00%	1	-9.32	-11.23
Grey	84.40%	4/5	-86.38	-81.88
Orange	83.80%	1	-86.85	-103.64
Fall 2015 Team Name	Project Grade	Placement	TSR	Performance Factor
Glamour	80%	1	12.81	10.25
Diamond	69%	5/6	12.72	7.31
Yellow	89%	3/4	6.87	4.59
Easy Tec	81%	2/3	7.74	4.18
Black & White	76%	1/2	0.73	0.28
SMMA	81%	5/6	0.18	0.12
MAS	90%	2/3	0.14	0.08
Silver	68%	1	-2.83	-4.16
Enchanting Neighbor		75%	5/6	-8.16 -9.07
MH 4	91%	5/6	-10.72	-9.82
Pearls	75%	1	-49.51	-66.01
Fancy	85%	1	-43.9	-51.65
Summer 2016 Team Name	Project Grade	Placement	TSR	Performance Factor
K&S	86.50%	1	7.63	6.60

Yellow	85.50%	1	1.11	0.95
Orange	76.50%	1/2	-0.64	-0.42
Cherry	84.50%	5/6	-22.83	-22.51
Creative	81%	1	-65.61	-81.00
S & N	76.50%	1	-89.36	-116.81
Fall 2016				
Team Name	Project Grade	Placement	TSR	Performance Factor
My Phone	86.00%	8/9	5.41	4.14
Creative	85.25%	7/9	-3.69	-3.37
Star Phone	81.10%	2/3	-7.55	-6.21
Spring 2017 Team Name	Project Grade	Placement	TSR	Performance Factor
Black	89%	1	10.47	9.32
Blue	76.00%	2/3	4.5	2.26
Red	85.00%	1/3	3.47	0.97
Spring 2018				
Team Name	Project Grade	Placement	TSR	Performance Factor
M.A.S.	88.00%	1	10.76	9.47
First Line	86.00%	4/5	9.57	6.58
Grey	88.00%	3/5	0.54	0.29
High Quality	85.50%	4/5	-6.37	-5.96
FSM	82%	1	-6.88	-8.39
Summer 2018				
Team Name	Project Grade	Placement	TSR	Performance Factor
Blue Eyes	90%	1	4.62	4.16
Orange	85.05%	1/2	-4.32	-2.54
Blue	87.88%	3/4	-6.28	-5.36
Red	68.80%	1	-12.36	-17.97

These seven semesters of competition yielded 44 unique teams that were handled by the PI. These are the teams for which complete project data is available, making these learners the main subjects for this study. Of these 44 teams, there were eight first place finishers. Twenty-four of these 44 teams, or 55 per cent, broke even, or made money for their shareholders, and twenty teams, or 45 per cent, lost money. As mentioned, in some cases, for simulations occurring from 2015 through 2017, other instructors handled teams in the simulation. Only those teams reporting to the PI, which completed the same basic group project, to the same specifications, were assessed by the PI and included in the analysis. This helped to maintain consistency, as there were some differences in the group project and the way it was assessed by different instructors. The overall placement criteria for a simulation metric included cases where the PI's teams were at times competing against teams fielded by other instructors. Thus, performance of other instructors' teams and their impact on the PI's teams were taken into consideration.

For Spring 2015, there were 11 teams divided into two universes, of six and five teams respectively. All the Spring 2015 teams were students of the PI. Fall 2015 saw 12 teams divided into two universes of six teams each, all of which were under the guidance of the PI. For Summer 2016, there were two universes of six teams each, and three teams in each universe were reporting to the PI, with the remaining teams reporting to a different instructor. Fall 2016 had one universe contested by nine teams; of these, only three teams were assigned for study with the PI. For Spring 2017, there were three teams, all in one universe, reporting to the PI. Spring 2018 and Summer 2018 saw five and four teams respectively, all competing in one universe and fully under the instruction of the PI.

A key ratio to the CESIM simulation is annualised total shareholder return, or TSR. This ratio can be used as the winning criterion, and is defined by CESIM as follows.

> The figure is an annualized percentage of the return to shareholders, and is composed of the change in share price, total dividends paid, and finally the interest accumulated from the dividends paid. The earlier the dividends are paid, the more time they have to earn interest. (Cesim Global Simulation Challenge, 2018)

As the winning criterion of the simulation, TSR is a metric that describes profits or monetary value accruing to the shareholders. The TSR was taken into account, but attenuated, when deriving the performance factor for the analysis, by taking into consideration team performance on the group project and overall numerical placement, such as first, second, third and so on through to last place. The algorithm proposed in this study, TSR x Project Grade x Placement, or TSR/ Project Grade x Placement, for the weaker performers, yields a net performance factor metric. Depending on simulation placement, and score on the group project, this performance factor acts as both an attenuating and a smoothing factor when applied to the raw TSR value. Thus, placement in the competition and score on the group project are given some weight in the analysis. Final placement in a game, and score on the project report where teams analyse their strategy and performance, describe a team's performance in the simulation relative to other teams. The placement factor was inverted for scoring purposes in the case of a TSR value below zero.

There were seven teams, or 16 per cent of the total number, spread across several semesters that either made very little money, or lost very little money. These teams have a net performance factor between –1.0 and +1.0. Twenty teams, or 45 per cent of those being studied, accrued substantially negative performance factors, and in seven of these cases, or 16 per cent of the teams, losses were massive, and would have resulted in firms being bankrupted directly during the simulation. Two of these poor performers were in Spring 2015, two in Fall 2015 and three in Summer 2016. The average performance factor of firms accruing massive losses was –74.42. Twelve other teams, or 27 per cent of the teams across a wide range of semesters, had clearly negative simulation performance factors averaging –7.62. This is losing money and is considered a poor performance, but was a vast improvement on teams that registered massive losses (Knight & Galletly 2017).

More of the PI's teams did well in the simulation compared to those that performed poorly. There were 18 teams, or 41 per cent, that performed fairly well. Their average simulation performance score was +7.26, the overall best being a team that scored +19.55. Seven of these high-performing teams scored a performance factor metric of 7.31 or higher. Hence, above-average returns were signalled by performance factors greater than 7.26 or higher.

Content Analysis Methodology

The content analysis approach used a collection of methods deployed over all five performance categories of firms, including three types of co-occurrence networks, specifically, correlation, centrality and one organised by variable, which in this case was by 'firm'. Multi-dimensional scaling was created for all five performance classes and explored in depth, focusing on unique aspects of the high-performance group. Content analysis as a methodology has previously been deployed in UAE; see Miller (2017a) for learning and understanding by taxation learners, and Miller (2017b) where content analysis was an effective approach for investigating for accounting learners, as they acquired accounting competencies valued in the workplace. The content analysis method, and specifically KH Coder, is popular globally, and can be found in over 1500 published articles (Higuchi, 2019). See Figures 3 to 6 on the pages that follow.

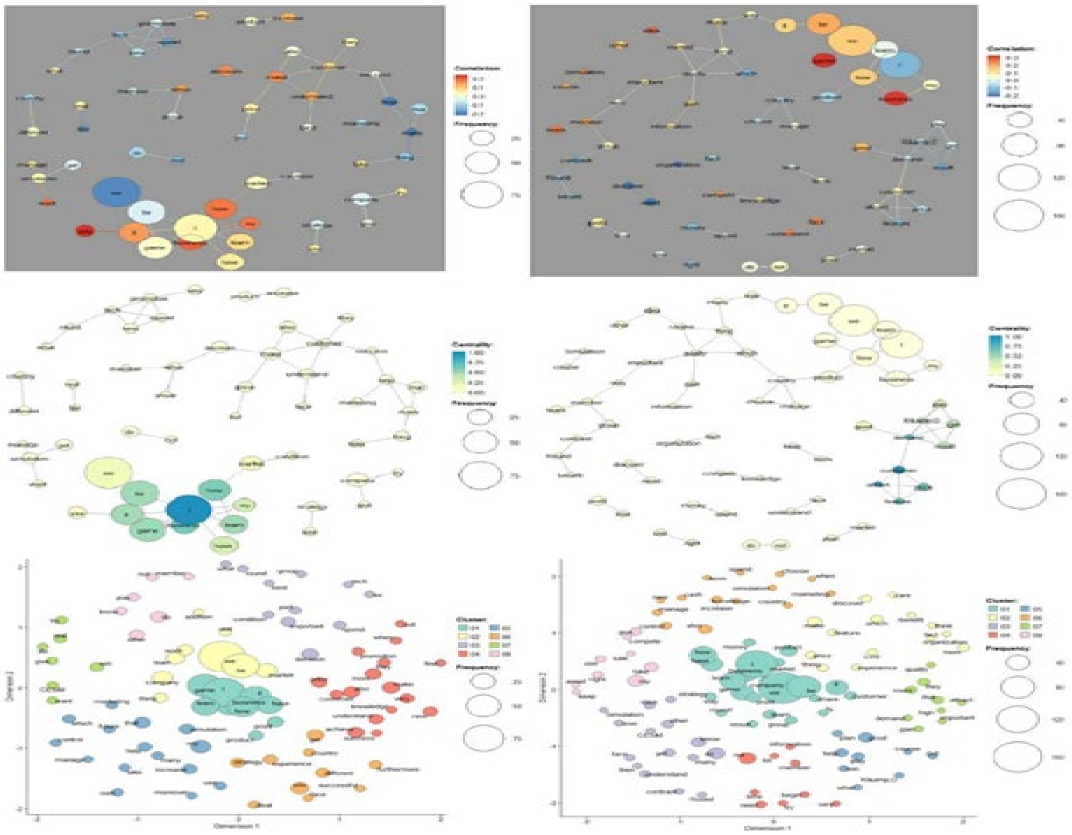


Figure 3 Co-Occurrence Network

In Figure 3, the first row is correlation co-occurrence network. The second row is the centrality co-occurrence network, and the third row is the analysis by multi-dimensional scaling. The high-performing teams are on the left, compared with the massive loss-accruing teams on the right. All co-occurrences are sentence structure-based, as are those on the following page. Note the structural differences, variations and similarities, in comparison with the high-performing team in particular.

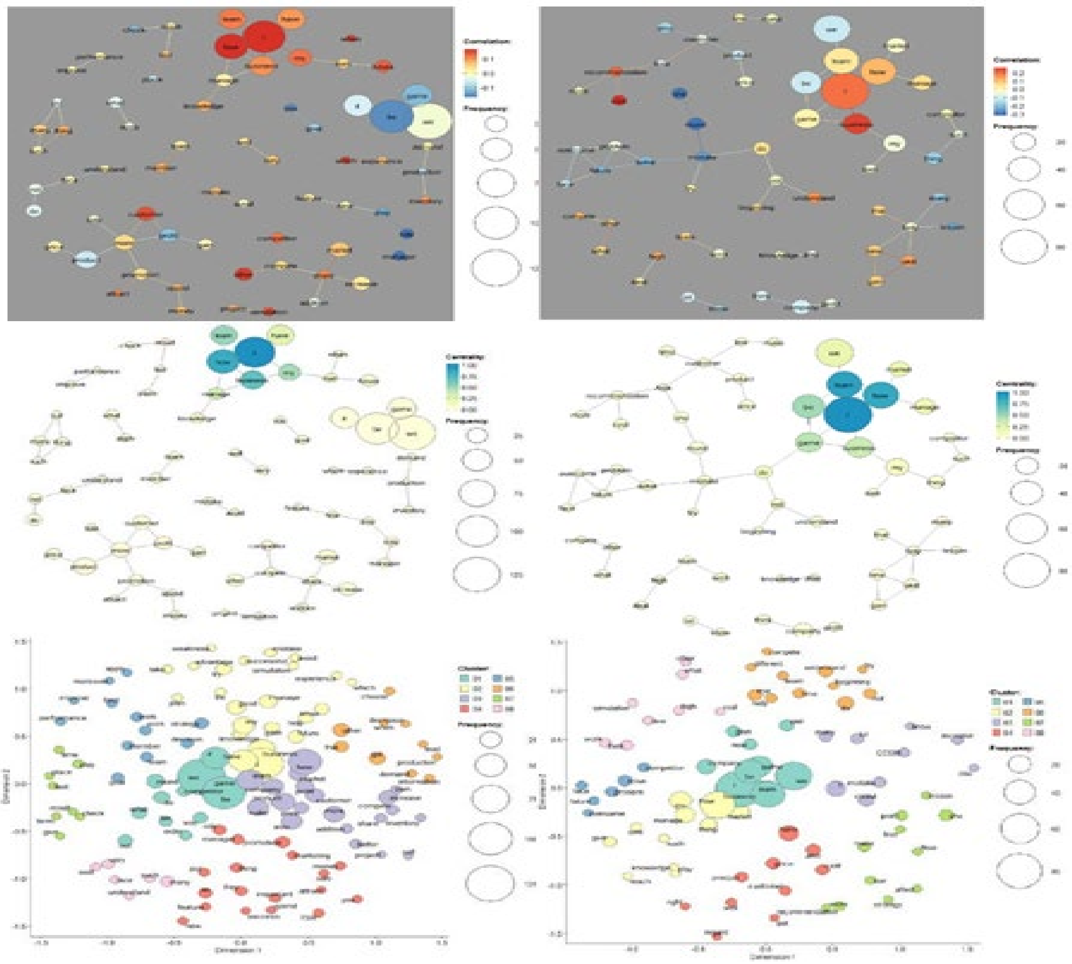


Figure 4a. Correlation co-occurrence, centrality co-occurrence networks, and multi-dimensional scaling of teams that performed well on the left, teams that broke even on the right.

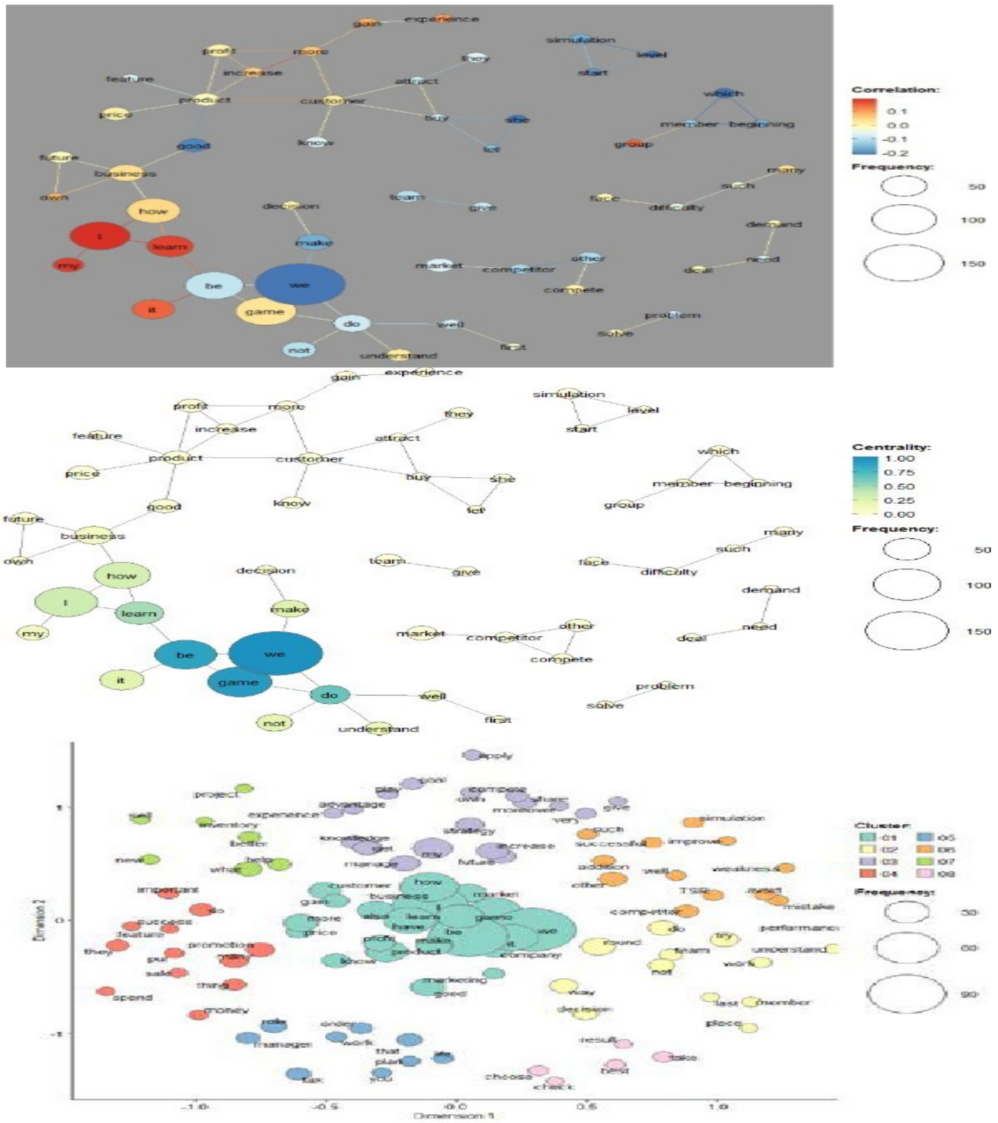


Figure 4b. Correlation co-occurrence, centrality co-occurrence networks and multi-dimensional scaling of teams with substantially high losses

Coding and data preparation were lengthy procedures. All three co-occurrence networks, correlation, centrality and the variable of ‘firm’ used the Jaccard distance calculation. For multidimensional scaling, using sentences, the Kruskal method was used, along with the Jaccard distance calculation. In all cases, darker connective lines indicated a stronger relationship.

When interpreting co-occurrence network produced by correlation, the researcher is presented with a heat map, and concepts of proximity and frequency. Structurally, the massive loss learners are positioned directly opposite the high performance simulation learners. In fact, all teams are largely structurally opposite from the high performance teams, except for the substantially high loss firms. At first glance, teams with substantially high losses appear structurally similar to the high performance teams; however, upon closer inspection, the cluster of phrases denoting ‘do not understand well’ defines and separates the substantially high loss firms. All teams produced a modularity sub-graph, which indicates strong connections within communities but sparse connections between the communities of nodes.

Viewing the co-occurrence centrality networks, it is possible to identify which constructs take on a bluish-hue that signifies a central concept. The massive loss firms’ main ideas are obtusely located compared with high performers, and attract, customer, price and feature are of the greatest centrality, differing entirely from all other groups. High performance teams show a concise centrality structure connected with market conditions. The more-or-less break even firms show a looser structure connected to many ideas and concepts, including ‘do not understand’. Substantially high loss teams showed how they learnt business on one hand, but also did not understand well. Teams that performed well saw the central concepts connected to manage knowledge and their own future. These objects were the result of unsupervised machine learning.

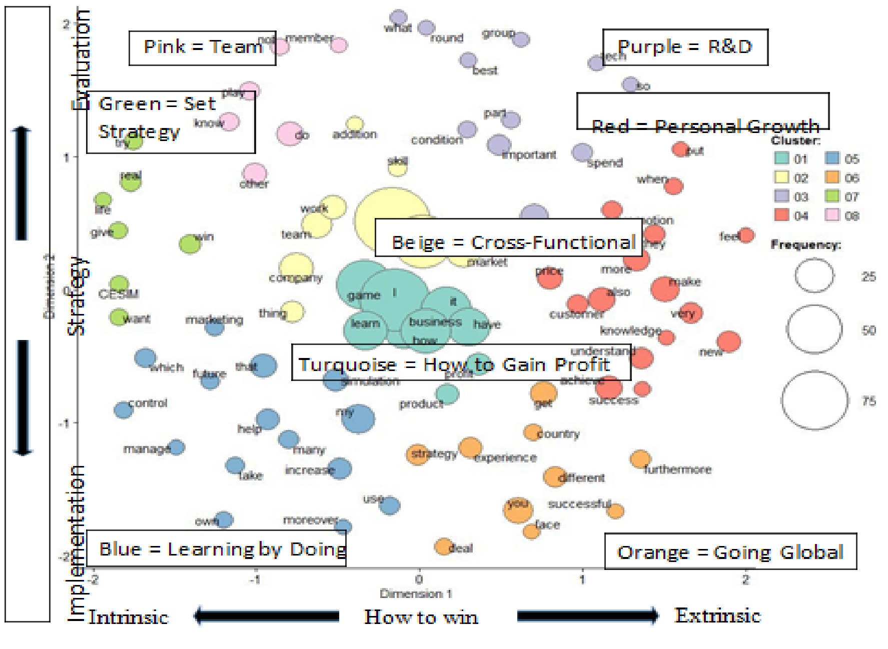


Figure 5. Multi-dimensional scaling for high performance firms

Multi-dimensional scaling (MDS) was analysed in depth for the high performance group and the researcher attempted to apply meaningful labels to as many clusters as possible (Higuchi, 2013) and all eight communities by using the named constructs as Google search terms. Communities were named as follows:

Pink = Team	Green = Set Strategy	Turquoise = How to Gain Profit
Purple = R&D	Red = Personal Growth	Blue = Learning-by-Doing

Inferring the names of each axis for multi-dimensional scaling yields that the x-axis is the Understanding of How to Win: Intrinsic vs. Extrinsic, left to right. The y-axis represents Strategy Evaluation at the top, and Strategy Implementation at the bottom. These terms were inferred from those constructs lying along each axis, and being used as Google search terms. Higuchi (2018) instructs that it is necessary to make some inferences on the interpretation.

To establish the co-occurrence network, with sentences organised by the variable heading of 'Firm', a unique and differentiating structure emerged. Those teams that exhibited the unique structure, happened to be those that scored well in the simulation, with the high performing teams having the greatest structure and massive losses teams exhibiting the most nebulous one. See Figure 6.

Highest performing firms showed greater structure and are on the top-left of Figure 6, with teams that performed well just below. Teams showing massive losses are in the upper-right quadrant, and those with substantially negative performance just below. At the bottom is the network for the teams that more-or-less broke even. Note the nebulous cloud-like structure of the teams that performed relatively poorly, and the intermediate structural development presented by the teams that broke even.

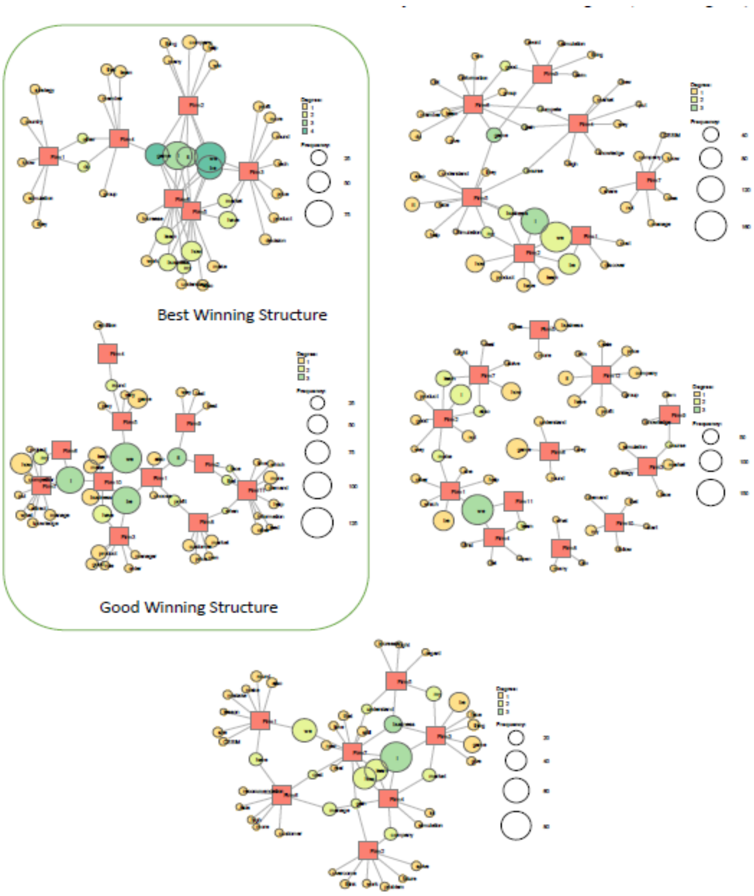


Figure 6. Co-occurrence networks variable 'firms'.

Discussion

Given the theme of the 2019 Transformative Business Models-Disruptive Innovation in Finance, Tourism and Logistics it was interesting that the 2018 ACBSP conference on Developing Entrepreneurial Leaders again featured collaboration with CESIM of Finland, and deployed its Global Challenge simulation competition, rebooting a previous effort from Dubai 2016.

There are inherent strengths of the approach deployed for this study. The simulation rewards teams that manage financial aspects successfully. One strength is the larger sample size than used in similar studies from the literature review. Another is the consistency obtained by using the data from only one instructor, which minimised any chance of coding errors, and differences in the approach taken by the instructor towards grading the project, hence increasing the reliability of the procedure.

The algorithm deployed for the performance score reduced the TSR value by multiplying by the percentage score in the group project or dividing in the case of a negative TSR value. The performance score was further attenuated if the team did not come in first place for their universe. Negative TSR scores were reduced even further with if they came in last place. The worst score using the performance metric was –116.81. The team scored 76.5 per cent on the project, came in last place for the universe and the TSR was –89.36. A team with a lower TSR improved compared with a team in another universe, due to achieving a higher placement in the game, or a higher score on the group project. The performance score was useful for comparing and categorising teams for descriptive reporting and organising them for the content analysis.

The content analysis method relied on the self-reported student experience via the reflections, and these were quantitatively analysed by KH Coder (2018). Content analysis produces highly complex data visualisations. While quantitative in origin, data are subject to interpretation. Data visualisation clearly demonstrated different structures for the teams that performed well compared with the teams that did not, such as the correlation, centrality and co-occurrence networks by firm. The multidimensional scaling was analysed in accordance with the method of the originator of the software, K. Higuchi. Using the Google search function, each community was assigned a plausible name, and each axis identified, although some creative liberty was taken interpreting the search results to make the inference. Teams that did well clearly understood and engaged with the simulation differently, based on the graphics from the quantitative machine learning application, KH Coder, in comparison to those that performed poorly in the simulation. A connection was made between the performance metrics and content graphics, showing that the high performers were better candidates to become entrepreneurial leaders.

Limitations

While the Global Challenge is the simulation platform undertaken by the students referenced in this study. The study does not measure the ability to successfully verbally pitch business ideas to investors, or the creation of an original and viable entrepreneurial concepts. However, in defence of the models here, the written project does measure the ability to convey entrepreneurial performance through a business report and, more importantly, the management of a business through simulated functions of estimating demand, managing production, marketing, R&D and logistics, and the important transfer pricing, repatriation of funds, taxation and entrepreneurial finance of initial launch and early phases of running a business.

Another limitation is that the natural language processing has produced very complex data across several dimensions and visualisations. Data should be subjected to further content analysis, interpretation and verification of results. Hierarchical cluster analysis, correspondence analysis and word frequency, along with the self-organising map, which is the most advanced unsupervised machine learning analytical feature of KH Coder, were not deployed for this study.

Unfortunately, 10 teams and 45 learners from Fall 2017 could not be included in the study because the PI was pulled out of teaching business simulation to chair efforts system-wide to complete a reaffirmation of accreditation self-study. Furthermore, some learners taught by other instructors who actually competed in the simulation were not included in the text analysis, or the performance algorithm, because the project results were not included in the study.

Recommendations

It would be good to identify learners who have later become successful entrepreneurs, and correlate those results with business simulations results. There would be some utility to identifying whether any were among the high performers from the simulation. While students reported in their reflections that the simulation had prepared them for the real world of business, discovering the efficacy of business simulation in modelling development of entrepreneurial financial skills is best served by producing actual entrepreneurs who are comparatively successful in both reality and the simulation.

The study could be improved by a larger sample size and the class will be offered again in the future. Since the PI is the primary instructor for strategic management and business simulation, an opportunity exists to collect additional data in the future. If the project could be sufficiently unified across different instructors and institutions teaching the course, then such data and hence the findings would be viewed as more robust.

REFERENCES

ACBSP (2016). ACBSP Regions: International Council - Region 8. Conference Proceedings, 2016 International Conference, November 23 – 27, 2016, Dubai, United Arab Emirates. Retrieved September 13, 2018, from https://www.acbsp.org/group/region%208

Amin, M., Baroto, M. B., Rasid, S. Z. A., and Ahmad, F. S. (2012). The Effects of Entrepreneurial Orientation on SME Performance. Advances in Global Business Research. Proceedings of the Ninth World Congress of the Academy for Global Business Advancement, 9(1), p 178-183. Ajman, United Arab Emirates. Retrieved September 13, 2018 from https://www.agba.us/pdf/2012-AGBA ajmanproceedings.pdf

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84(2), 191-215

Barišić, A. F., and Prović, M., (2014). Business simulation as a tool for entrepreneurial learning: The role of business simulation in entrepreneurship education. Education for Entrepreneurship - E4E: International Journal of Education for Entrepreneurship, 4(2), p 97-107. Retrieved September 13, 2018 from: https://hrcak.srce.hr/index.php?show=toc&id_broj=10851

Buja, A., Swayne D. F., Littman M. L., Dean, N., Hofman, H., & Chen, L. (2008). Data Visualization with Multidimensional Scaling. Journal of Computational and Graphical Statistics, 17(2), 444-472. doi=10.1198%2F106186008X318440

Cesim Global Simulation Challenge (2018). Cesim Instructor, Results, Ratios. Retrieved September 13 from: https://www.cesim.com/simulations/cesim-global-challengeinternational- business-strategy-simulation-game

De Klerk, J. (2015, April 6). Exploring the use of a business simulation to teach business concepts to Emirati student. Developments in Business Simulation and Experiential Learning, 42. p 51. Retrieved from https://journals.tdl.org/absel/index.php/absel/article/view/2909/2860.

Castellano, N. G., & Corsi, K., Bartolini, M., Bernini, F., Cardoni , A., Coller, G., Fasone, V., Fornaciari, L. (2018). A data-driven analysis of the current debate on the linkages between performance and strategy studies, International Journal of Business Performance Management, Inderscience Enterprises Ltd, 19(1), p 105-129.

Heydari, M., Xiaohu, Z., & Wang, S.-b. (2019). Entrepreneurship activities effect on emotions and Behavior. Retrieved from https://www.researchgate.net/publication/331175570_Entrepreneurship_activities_effect_on_emotions_and_Behavior

Higuchi, K. (2019). Research Using KH Coder, KH Coder website. Retrieved from https://khcoder.net/en/bib.html?year=2018&lang=English&key=

KH Coder, (2016). Open source software, Higuchi, Koichi, Ritsumeikan University, Japan. Available at http://khc.sourceforge.net/.

Kikot, T., Fernandes S., Magalhães, R., and Costa, G. (2013). Implementation of business simulation games as learning tool: An example from University of Algarve. Retrieved September 13, 2018, from https://core.ac.uk/download/pdf/61507482.pdf

Knight, B.A. and Galletly, S. 2017. Effective literacy instruction for all students: A time for change. International Journal of Innovation, Creativity and Change, 3(1): 65-86.

Kumar, B. K., and Ryoke, M., (2013). Analyzing the Business Strategies of Mobile Phone Operators Using Agent-Based Simulation. International Journal of Knowledge and Systems Science, 4(2), 1947-8208, DOI:10.4018//JKSS.2013040106

Lee, P. Y. K., Hung, S-Y, and Chau, W-T, (2011). Influence of Knowledge Management Infrastructure on Innovative Business Processes and Market-Interrelationship Performance: An Empirical Study of Hospitals in Taiwan. Journal of Global Information Management, 19(2), p 67-89. DOI: 10.4018/jgim.2011040104

Mariotti, S., Rabuzzi, D. (2009). Entrepreneurship for Youth in Educating the Next Wave of Entrepreneurs Unlocking entrepreneurial capabilities to meet the global challenges of the 21st Century. World Economic Forum, Report On Entrepreneurship Education, 24-40. DOI: 10.2139/ssrn.1396704

Markulis. P. M., Nugent, M., and Strang, M. (2015). Assessing the role of assessment in business simulations. Developments in Business Simulation and Experiential Learning, 42, p 124-132. Retrieved September 14 from https://absel-ojsttu.tdl.org/absel/index.php/absel/article/view/2921

Miller, A. (2016). Benchmarking learner education using online business simulation. International Journal of Cyber Society and Education, 9(1). p 17-34. doi: 10.7903/ijcse.1418

Miller, A. H. (2017a) A Corpus-based Computer Aided Linguistic Analysis of Taxation Learning Outcomes. Proceedings of International Conference on Business, Big-Data, and Decision Sciences (ICBBD), 12-20 Miller/publication/319403342_A_Corpus-based_Computer_Aided_Linguistic_Analysis_of_Taxation_Learning_Outcomes/links/59a82ed6458515eafa8833fe/A-Corpus-based-Computer-Aided-Linguistic-Analysis-of-Taxation-Learning-Outcomes.pdf#page=17">LinkNeely, P. & Tucker, J. (2012). Using business simulations as authentic assessment tools. American Journal of Business Education, 5(4), p. 449-456. doi: 10.19030/ajbe.v5i4.7122

Miller, A. H. (2017b). Preparing Students for Career Success in Accounting: The SCIL-based Model with a Focus on Content Analysis. Transnational Journal of Business, p. 51-81. Retrieved from: http://www.acbsp.org /members /group.aspx? id=143359

Rogmans, T. (2016). Effective Use of Business Simulation Games in International Business Courses. Academy of International Business Insights, 16(2). p 19-22. Retrieved September 13, 2018 from: https://documents.aib.msu.edu/publications/insights/v16n2/v16n2_Insights_Full.pdf

Shaheen, N., & Al-Haddad, S. (2018). Entrepreneurial self-efficacy and entrepreneurial behavior. International Journal of Development and Sustainability . Retrieved from https://www.researchgate.net/publication/330006170_Entrepreneurial_self-efficacy_and_entrepreneurial_behavior

Usoro, A (2001). Can Information Technology Help Managers Plan Globally? Journal of Global Information Management 9(1):17-24. DOI: 10.4018/jgim.2001010103

Vnoučková, L. (2018), Criteria of Innovativeness and Creativity in Start-Ups and Innovative Entrepreneurship. Quality Innovation Prosperity / Kvalita Inovácia Prosperita, 22(1), p 27-42. doi: 10.12776/QIP.V22I1.1040

Volkmann, C. (2009). Entrepreneurship in Higher Education, in Educating the Next Wave of Entrepreneurs, Unlocking entrepreneurial capabilities to meet the global challenges of the 21st Century. World Economic Forum, Report On Entrepreneurship Education, 42-52. DOI: 10.2139/ssrn.1396704

Vyakarnam, S. (2009). Entrepreneurship education for social inclusion in Educating the Next Wave of Entrepreneurs Unlocking entrepreneurial capabilities to meet the global challenges of the 21st Century. World Economic Forum, Report On Entrepreneurship Education, 80-99. DOI: 10.2139/ssrn.1396704

Wang, J. (2017). Multi-Agent based Production Management Decision System Modelling for the Textile Enterprise. Journal of Global Information Management, IGI Global, 25(4), 1-15, October.

Wilson K. E. (2009). Overall Recommendations, in Educating the Next Wave of Entrepreneurs Unlocking entrepreneurial capabilities to meet the global challenges of the 21st Century. World Economic Forum, Report On Entrepreneurship Education. DOI: 10.2139/ssrn.1396704

Zhang. C., Chen. H., Hong, and Phang. C.W., (2018). Role of Instructors' Forum Interactions with Students in Promoting MOOC Continuance. Journal of Global Information Management IGI Global, 26(3), 105-120. DOI: 10.4018/JGIM.2018070108